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Records of magma-crust interaction as constraints on the sub-basalt basement beneath the Faroe Islands

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The Faroe Islands Basalt Group is ~6 km thick and is underlain by ~38 km continental crust, as estimated by geophysical surveys[1]. The exact nature of these continental rocks is unknown, though previous studies have presumed an Archean basement, probably overlain by sediments related to the pre-volcanic rifting. Potential onshore equivalents of the basement rocks can be found in Scotland and East Greenland.

In this study, we employ multiple geobarometric models coupled with Sr, and He isotope signatures to decipher crustal influences in the Faroe basalts. This approach allows us to construct "virtual geochemical boreholes" through the basalts into the underlying crustal basement.

In-situ analyses of plagioclase exhibit a range of measured 87Sr/86Sr signatures between 0.70331 - 0.70498. Helium isotopes from olivine and pyroxene separates record both primitive as well as highly crustal values. Anorthite contents in plagioclase are separated into two populations: An62-72 and An80-90, suggesting two main levels of fractionation. The majority of the analysed rocks record shallow depths of fractionation (<10 km) corresponding with the upper part of the basement rocks plus intrabasaltic storage. This, coupled with helium isotope signatures with significant crustal input, indicate a scenario with widespread melting and assimilation of the underlying continental crust. The wide range of Sr and He isotope signatures, indicate a complex plumbing system with variable degrees and depth levels of assimilation.

We present a preliminary virtual geochemical borehole through the basalts, attempting to identify the general lithostratigraphy of the sub-basaltic basement.

Reference:

[1] Richardson et al 1999, Petrol. Geosci. 5, 161-172.

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